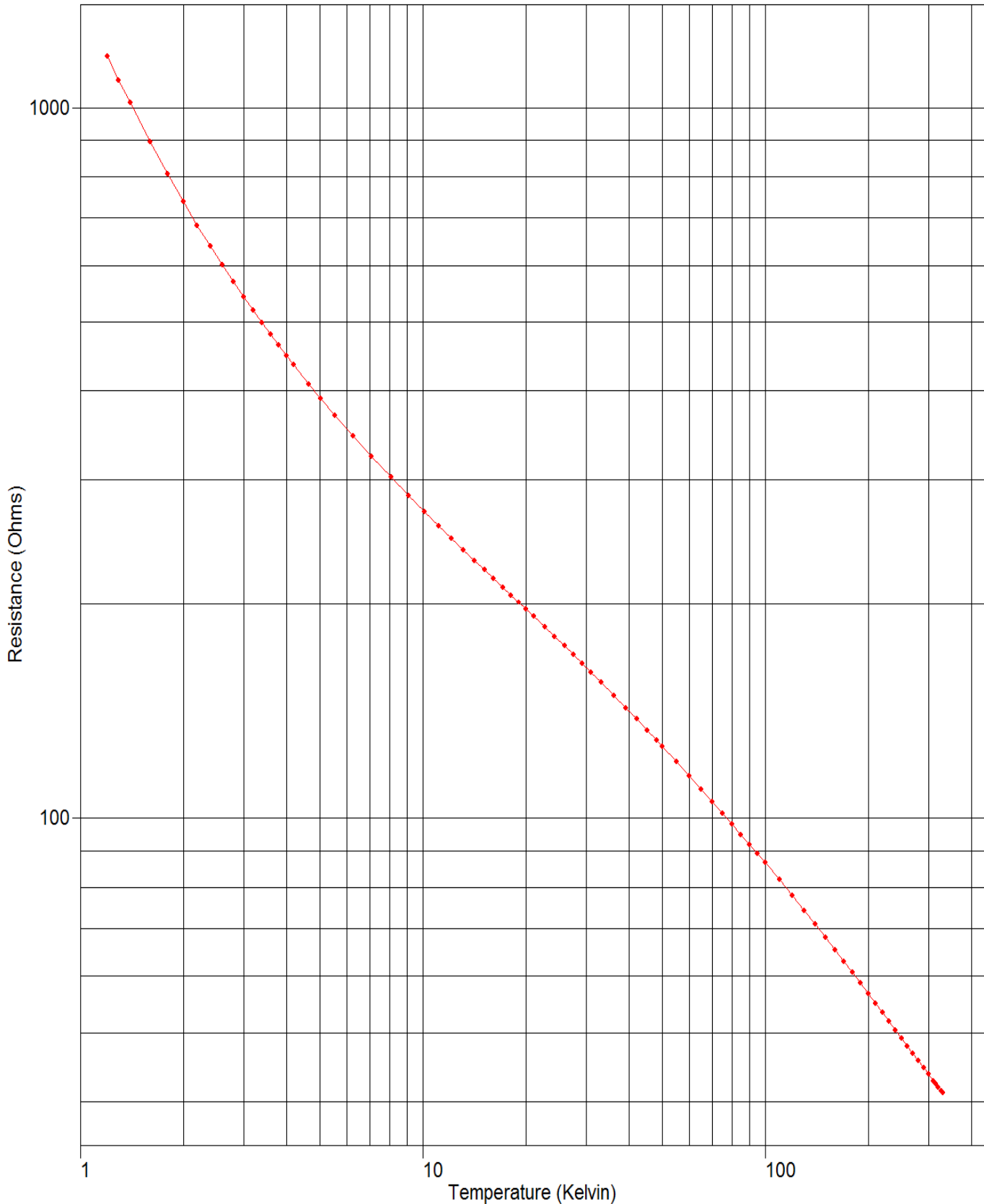


DATA PLOT

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K



TEST DATA

Calibration Report: 626217

Sensor Model: CX-1030-SD-1.4L

Sensor Type: Cernox Resistor

Sales Order: 63511

Serial Number: X68201

Temperature Range: 1.40K to 325K

Index	Temp. (K)	Resistance (Ω)	Excitation	Index	Temp. (K)	Resistance (Ω)	Excitation
1	1.20375	1182.57	2mV \pm 25%	46	42.1757	137.757	2mV \pm 25%
2	1.29824	1094.33	2mV \pm 25%	47	45.1722	133.027	2mV \pm 25%
3	1.40039	1015.47	2mV \pm 25%	48	48.1735	128.712	2mV \pm 25%
4	1.59926	895.362	2mV \pm 25%	49	50.1607	126.044	2mV \pm 25%
5	1.79924	806.219	2mV \pm 25%	50	55.1594	119.963	2mV \pm 25%
6	2.00089	737.211	2mV \pm 25%	51	60.1555	114.592	2mV \pm 25%
7	2.19962	682.998	2mV \pm 25%	52	65.1463	109.823	2mV \pm 25%
8	2.40062	638.101	2mV \pm 25%	53	70.1419	105.543	2mV \pm 25%
9	2.60077	600.790	2mV \pm 25%	54	75.1351	101.662	2mV \pm 25%
10	2.80017	569.293	2mV \pm 25%	55	80.1264	98.1354	2mV \pm 25%
11	3.00057	542.074	2mV \pm 25%	56	85.1200	94.9005	2mV \pm 25%
12	3.20021	518.516	2mV \pm 25%	57	90.1129	91.9281	2mV \pm 25%
13	3.39986	497.822	2mV \pm 25%	58	95.1061	89.1623	2mV \pm 25%
14	3.59953	479.478	2mV \pm 25%	59	100.112	86.5951	2mV \pm 25%
15	3.79914	463.086	2mV \pm 25%	60	110.102	81.9585	2mV \pm 25%
16	3.99948	448.307	2mV \pm 25%	61	120.099	77.8749	2mV \pm 25%
17	4.20302	434.637	2mV \pm 25%	62	130.096	74.2445	2mV \pm 25%
18	4.65065	408.904	2mV \pm 25%	63	140.089	70.9857	2mV \pm 25%
19	5.05194	389.489	2mV \pm 25%	64	150.087	68.0389	2mV \pm 25%
20	5.55479	368.951	2mV \pm 25%	65	160.089	65.3615	2mV \pm 25%
21	6.26060	345.403	2mV \pm 25%	66	170.088	62.9193	2mV \pm 25%
22	7.07258	323.696	2mV \pm 25%	67	180.085	60.6838	2mV \pm 25%
23	8.08733	302.073	2mV \pm 25%	68	190.076	58.6230	2mV \pm 25%
24	9.10189	284.761	2mV \pm 25%	69	200.081	56.7295	2mV \pm 25%
25	10.1179	270.470	2mV \pm 25%	70	210.086	54.9725	2mV \pm 25%
26	11.1378	258.324	2mV \pm 25%	71	220.078	53.3454	2mV \pm 25%
27	12.1513	247.915	2mV \pm 25%	72	230.076	51.8335	2mV \pm 25%
28	13.1573	238.909	2mV \pm 25%	73	240.080	50.4233	2mV \pm 25%
29	14.1620	230.893	2mV \pm 25%	74	250.069	49.1093	2mV \pm 25%
30	15.1510	223.822	2mV \pm 25%	75	260.072	47.8798	2mV \pm 25%
31	16.1396	217.423	2mV \pm 25%	76	270.070	46.7263	2mV \pm 25%
32	17.1192	211.629	2mV \pm 25%	77	280.013	45.6506	2mV \pm 25%
33	18.0988	206.317	2mV \pm 25%	78	290.076	44.6281	2mV \pm 25%
34	19.0785	201.390	2mV \pm 25%	79	300.079	43.6719	2mV \pm 25%
35	20.0598	196.801	2mV \pm 25%	80	310.080	42.7687	2mV \pm 25%
36	21.1425	192.094	2mV \pm 25%	81	315.085	42.3372	2mV \pm 25%
37	22.7222	185.793	2mV \pm 25%	82	320.083	41.9185	2mV \pm 25%
38	24.3306	179.966	2mV \pm 25%	83	326.076	41.4321	2mV \pm 25%
39	25.9483	174.615	2mV \pm 25%	84	330.079	41.1146	2mV \pm 25%
40	27.5820	169.642	2mV \pm 25%				
41	29.2132	165.073	2mV \pm 25%				
42	31.0468	160.298	2mV \pm 25%				
43	33.1649	155.237	2mV \pm 25%				
44	36.1778	148.754	2mV \pm 25%				
45	39.1747	142.972	2mV \pm 25%				



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UNCERTAINTY ANALYSIS

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Calibration Data Uncertainty

The uncertainties of the measured calibration data for Lake Shore's sensors are summarized in the table below. The values given are the combined uncertainty of the temperature measurement and the resistance or voltage measurement expressed as an equivalent temperature uncertainty in millikelvin (mK). Note that the values are the calibration uncertainty only and do not include the stability of the temperature sensor. The uncertainty analysis has followed the guidelines for determining measurement uncertainty as outlined in the ISO Guide to the Expression of Uncertainty in Measurement, NIST Technical Note 1297, and ANSI/NCSL Z540-2-1997. Since the uncertainty varies with temperature due to the variation of the sensor sensitivity and excitation, the table gives typical values at several different temperatures throughout the range of the calibration. The uncertainty is based on an approximate 95% confidence level with a coverage factor $k = 2$.

T (K)	Uncertainty (+/- mK)											
	Ge (GR-200-X)		Cernox (CX-Y)		CGR	RX		Pt		RhFe		Diode
	$X \leq 100$	$X \geq 250$	$Y \leq 1030$	$Y \geq 1050$		-102	-103	100 Ω	25 Ω	27 Ω	100 Ω	
1.4	4	4	4	4	4	4	4			4	4	7
4.2	4	4	4	4	4	4	6			4	4	5
10	4	4	5	4	4	10	15			4	5	6
20	8	7	9	8	8	34	34	8	10	8	9	9
30	9	8	11	9	9	72	60	8	8	9	9	28
50	12	11	16	12	13			10	10	10	10	34
100	32	18	24	16	27			11	11	11	11	30
300			72	40	100			22	22	22	22	33
400			120	67				43	43	42		47
500								48	48			52

Polynomial Fit Uncertainty

When a sensor is used to measure temperature, a polynomial fit to the measured calibration data is often used to convert the sensor resistance (R) or voltage (V) to a temperature (T). How well the polynomial represents the sensor calibration data is another source of uncertainty when using the sensor. In the polynomials provided with this set of calibration data, the standard deviation of the fit can be used as an estimate of this additional temperature uncertainty. The standard deviation of fit is determined from the following equation:

$$\sigma_{fit}^2 = \frac{\sum_{i=1}^N (T_i - T_{i,calc})^2}{N - n} = \frac{N}{N - n} (\Delta T_{RMS})^2$$

where σ_{fit} = standard deviation of the fit

T_i = measured temperature for point i

$T_{i,calc}$ = the temperature calculated from the polynomial equation for point i

N = number of data points in fit range

n = number of fit coefficients

ΔT_{RMS} = root mean square deviation of fit

A value of ΔT_{RMS} is given for each range of fit.

F008-04-00 (08/06/04)



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

1.40 K to 14.2 K
1015. Ohms to 230.9 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:

ZL = 2.33730499101 ZU = 3.07282582571

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	5.762371	1.3968E-04	41255.54
1	-6.553626	2.2532E-04	-29085.36
2	2.678667	1.9861E-04	13486.97
3	-0.872372	2.0324E-04	-4292.36
4	0.228791	1.9649E-04	1164.36
5	-0.044181	1.8620E-04	-237.28
6	0.003171	1.7619E-04	18.00
7	0.001909	1.7799E-04	10.73
8	-0.001581	1.7925E-04	-8.82
9	0.000517	1.8034E-04	2.87

$Z = \text{Log}(\text{Resistance})$

$k = ((Z - Z_L) - (Z_U - Z)) / (Z_U - Z_L)$

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$, where $0 \leq i \leq 9$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
1	1182.567	1.20375	1.20367	0.08
2	1094.326	1.29824	1.29857	-0.34
3	1015.475	1.40039	1.40002	0.37
4	895.3617	1.59926	1.59920	0.06
5	806.2188	1.79924	1.79956	-0.33
6	737.2115	2.00089	2.00100	-0.11
7	682.9981	2.19962	2.19946	0.15
8	638.1006	2.40062	2.40037	0.25
9	600.7904	2.60077	2.60065	0.12
10	569.2927	2.80017	2.80010	0.06
11	542.0741	3.00057	3.00069	-0.12
12	518.5158	3.20021	3.20038	-0.16
13	497.8216	3.39986	3.40002	-0.16
14	479.4778	3.59953	3.59962	-0.09
15	463.0862	3.79914	3.79920	-0.06
16	448.3068	3.99948	3.99916	0.32
17	434.6369	4.20302	4.20364	-0.61
18	408.9040	4.65065	4.64981	0.84
19	389.4890	5.05194	5.05179	0.15
20	368.9510	5.55479	5.55531	-0.53
21	345.4025	6.26060	6.26069	-0.09
22	323.6962	7.07258	7.07170	0.87
23	302.0733	8.08733	8.08798	-0.65
24	284.7615	9.10189	9.10278	-0.89
25	270.4700	10.11792	10.11709	0.83
26	258.3242	11.13776	11.13718	0.58
27	247.9151	12.15129	12.15250	-1.21
28	238.9092	13.15728	13.15588	1.40
29	230.8934	14.16201	14.16243	-0.43
30	223.8220	15.15101	15.15176	-0.75
31	217.4228	16.13963	16.13917	0.46

Order of Fit = 9 RMS error of fit = 0.55 mK
Largest absolute error = 1.40 mK at data point no. 28



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

14.2 K to 80.1 K
230.9 Ohms to 98.14 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.96344822049 ZU = 2.39430289458

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	43.023043	5.8760E-04	73217.74
1	-38.075024	9.5886E-04	-39708.46
2	8.019533	8.7476E-04	9167.74
3	-0.902316	8.2311E-04	-1096.23
4	0.096593	7.8783E-04	122.61
5	-0.001061	7.5677E-04	-1.40
6	-0.008270	7.4594E-04	-11.09
7	-0.001262	7.2160E-04	-1.75

$Z = \text{Log}(\text{Resistance})$

$k = ((Z - Z_L) - (Z_U - Z)) / (Z_U - Z_L)$

$\text{Temp. (K)} = \sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$, where $0 \leq i \leq 7$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
27	247.9151	12.15250	12.15124	1.26
28	238.9092	13.15588	13.15765	-1.77
29	230.8934	14.16243	14.16327	-0.84
30	223.8220	15.15101	15.15153	-0.52
31	217.4228	16.13963	16.13916	0.47
32	211.6289	17.11919	17.11898	0.20
33	206.3170	18.09882	18.09629	2.53
34	201.3905	19.07851	19.07660	1.91
35	196.8007	20.05977	20.05944	0.33
36	192.0941	21.14254	21.14277	-0.24
37	185.7932	22.72225	22.72394	-1.70
38	179.9658	24.33057	24.33358	-3.01
39	174.6150	25.94829	25.95019	-1.90
40	169.6423	27.58201	27.58425	-2.25
41	165.0732	29.21323	29.20909	4.14
42	160.2981	31.04677	31.04641	0.36
43	155.2370	33.16488	33.16601	-1.13
44	148.7543	36.17783	36.17347	4.36
45	142.9720	39.17467	39.17337	1.30
46	137.7566	42.17568	42.17527	0.41
47	133.0274	45.17216	45.17485	-2.69
48	128.7123	48.17349	48.17307	0.42
49	126.0441	50.16069	50.16580	-5.10
50	119.9626	55.15944	55.15590	3.55
51	114.5918	60.15551	60.15745	-1.94
52	109.8228	65.14633	65.14769	-1.37
53	105.5433	70.14189	70.13536	6.53
54	101.6618	75.13511	75.13660	-1.48
55	98.13539	80.12637	80.12659	-0.22
56	94.90047	85.11999	85.12396	-3.97
57	91.92809	90.11291	90.11056	2.35

Order of Fit = 7 RMS error of fit = 2.50 mK
Largest absolute error = 6.53 mK at data point no. 53



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

80.1 K to 325. K
98.14 Ohms to 41.52 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.61399607581 ZU = 2.02343073076

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	178.541596	1.3243E-03	134821.11
1	-127.129402	2.0567E-03	-61811.00
2	20.993778	1.9584E-03	10719.75
3	-2.739589	1.8689E-03	-1465.87
4	0.561140	1.7778E-03	315.63
5	-0.101991	1.7794E-03	-57.32
6	0.010455	1.7644E-03	5.93
7	-0.004687	1.7148E-03	-2.73
8	0.003789	1.6942E-03	2.24

$Z = \text{Log}(\text{Resistance})$

$k = ((Z - ZL) - (ZU - Z)) / (ZU - ZL)$

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$, where $0 \leq i \leq 8$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
53	105.5433	70.13536	70.13509	0.27
54	101.6618	75.13660	75.13615	0.45
55	98.13539	80.12659	80.12821	-1.62
56	94.90047	85.11999	85.12408	-4.09
57	91.92809	90.11291	90.10436	8.55
58	89.16231	95.10609	95.10950	-3.41
59	86.59514	100.11184	100.10789	3.95
60	81.95850	110.10164	110.10636	-4.72
61	77.87486	120.09877	120.10411	-5.34
62	74.24445	130.09594	130.09235	3.59
63	70.98571	140.08925	140.08408	5.17
64	68.03886	150.08687	150.08619	0.68
65	65.36150	160.08933	160.09045	-1.12
66	62.91926	170.08781	170.08994	-2.13
67	60.68376	180.08466	180.07892	5.74
68	58.62301	190.07581	190.09399	-18.18
69	56.72952	200.08080	200.07139	9.41
70	54.97252	210.08554	210.08120	4.34
71	53.34536	220.07760	220.07915	-1.54
72	51.83349	230.07623	230.07353	2.69
73	50.42325	240.08040	240.08160	-1.20
74	49.10932	250.06861	250.07119	-2.57
75	47.87983	260.07225	260.06562	6.62
76	46.72625	270.06967	270.07468	-5.01
77	45.65061	280.01280	280.01822	-5.41
78	44.62813	290.07553	290.07497	0.56
79	43.67189	300.07911	300.06953	9.58
80	42.76872	310.08017	310.08669	-6.52
81	42.33716	315.08504	315.08795	-2.91
82	41.91853	320.08255	320.08099	1.56
83	41.43213	326.07634	326.06665	9.69
84	41.11460	330.07934	330.08643	-7.08

Order of Fit = 8 RMS error of fit = 5.84 mK
Largest absolute error = -18.18 mK at data point no. 68



INTERPOLATION TABLE

Calibration Report: 626217
Sensor Model: CX-1030-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 63511
Serial Number: X68201
Temperature Range: 1.40K to 325K

<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>	<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>
1.400	1015.49	-709.36	-0.97795	15.50	221.493	-6.5671	-0.45956
1.500	950.300	-598.81	-0.94519	16.00	218.288	-6.2590	-0.45877
1.600	894.954	-511.60	-0.91463	16.50	215.230	-5.9785	-0.45833
1.700	847.388	-442.23	-0.88719	17.00	212.306	-5.7199	-0.45801
1.800	806.049	-386.62	-0.86338	17.50	209.506	-5.4813	-0.45785
1.900	769.719	-341.38	-0.84268	18.00	206.822	-5.2609	-0.45786
2.000	737.516	-303.87	-0.82405	18.50	204.243	-5.0570	-0.45805
2.100	708.741	-272.46	-0.80729	19.00	201.762	-4.8675	-0.45837
2.200	682.866	-245.78	-0.79183	19.50	199.373	-4.6911	-0.45882
2.300	659.458	-222.94	-0.77755	20.00	197.069	-4.5265	-0.45938
2.400	638.175	-203.19	-0.76415	21.00	192.695	-4.2284	-0.46081
2.500	618.734	-186.02	-0.75160	22.00	188.601	-3.9653	-0.46254
2.600	600.901	-170.97	-0.73974	23.00	184.755	-3.7315	-0.46453
2.700	584.481	-157.71	-0.72856	24.00	181.130	-3.5220	-0.46667
2.800	569.308	-145.98	-0.71798	25.00	177.704	-3.3334	-0.46895
2.900	555.241	-135.55	-0.70797	26.00	174.457	-3.1623	-0.47129
3.000	542.161	-126.23	-0.69849	27.00	171.374	-3.0066	-0.47369
3.100	529.962	-117.88	-0.68952	28.00	168.440	-2.8641	-0.47611
3.200	518.557	-110.36	-0.68100	29.00	165.642	-2.7331	-0.47851
3.300	507.867	-103.56	-0.67293	30.00	162.970	-2.6124	-0.48090
3.400	497.823	-97.407	-0.66527	31.00	160.414	-2.5007	-0.48326
3.500	488.367	-91.811	-0.65799	32.00	157.966	-2.3970	-0.48558
3.600	479.445	-86.707	-0.65106	33.00	155.618	-2.3005	-0.48785
3.700	471.011	-82.041	-0.64447	34.00	153.363	-2.2106	-0.49007
3.800	463.024	-77.762	-0.63819	35.00	151.195	-2.1263	-0.49221
3.900	455.447	-73.828	-0.63219	36.00	149.108	-2.0474	-0.49430
4.000	448.248	-70.202	-0.62646	37.00	147.098	-1.9733	-0.49636
4.200	434.869	-63.760	-0.61580	38.00	145.160	-1.9036	-0.49833
4.400	422.684	-58.210	-0.60595	39.00	143.290	-1.8380	-0.50025
4.600	411.536	-53.391	-0.59679	40.00	141.483	-1.7760	-0.50212
4.800	401.286	-49.200	-0.58850	42.00	138.047	-1.6620	-0.50566
5.000	391.823	-45.506	-0.58070	44.00	134.827	-1.5597	-0.50901
5.200	383.054	-42.246	-0.57350	46.00	131.801	-1.4675	-0.51218
5.400	374.901	-39.341	-0.56666	48.00	128.951	-1.3839	-0.51515
5.600	367.296	-36.758	-0.56043	50.00	126.260	-1.3081	-0.51800
5.800	360.181	-34.434	-0.55449	52.00	123.715	-1.2388	-0.52070
6.000	353.508	-32.333	-0.54879	54.00	121.301	-1.1754	-0.52325
6.500	338.487	-27.929	-0.53633	56.00	119.009	-1.1173	-0.52576
7.000	325.432	-24.423	-0.52533	58.00	116.829	-1.0638	-0.52815
7.500	313.949	-21.597	-0.51593	60.00	114.751	-1.0145	-0.53047
8.000	303.752	-19.268	-0.50747	65.00	109.957	-0.90673	-0.53601
8.500	294.613	-17.342	-0.50034	70.00	105.654	-0.81704	-0.54132
9.000	286.361	-15.714	-0.49387	75.00	101.763	-0.74126	-0.54632
9.500	278.858	-14.335	-0.48835	77.35	100.059	-0.70964	-0.54858
10.00	271.995	-13.148	-0.48338	80.00	98.2221	-0.67693	-0.55135
10.50	265.682	-12.124	-0.47916	85.00	94.9776	-0.62220	-0.55683
11.00	259.849	-11.229	-0.47535	90.00	91.9880	-0.57471	-0.56229
11.50	254.434	-10.446	-0.47215	95.00	89.2206	-0.53312	-0.56765
12.00	249.388	-9.7548	-0.46938	100.0	86.6487	-0.49643	-0.57292
12.50	244.666	-9.1425	-0.46709	105.0	84.2496	-0.46382	-0.57805
13.00	240.235	-8.5893	-0.46480	110.0	82.0047	-0.43469	-0.58309
13.50	236.067	-8.0927	-0.46280	115.0	79.8977	-0.40856	-0.58805
14.00	232.133	-7.6559	-0.46173	120.0	77.9149	-0.38495	-0.59289
14.50	228.403	-7.2684	-0.46143	125.0	76.0445	-0.36355	-0.59760
15.00	224.860	-6.9057	-0.46066	130.0	74.2762	-0.34405	-0.60216



INTERPOLATION TABLE

Calibration Report: 626217

Sensor Model: CX-1030-SD-1.4L

Sensor Type: Cernox Resistor

Sales Order: 63511

Serial Number: X68201

Temperature Range: 1.40K to 325K

<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>	<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>
135.0	72.6012	-0.32621	-0.60657	235.0	51.1270	-0.14095	-0.64784
140.0	71.0117	-0.30981	-0.61078	240.0	50.4344	-0.13614	-0.64784
145.0	69.5010	-0.29468	-0.61480	245.0	49.7652	-0.13156	-0.64770
150.0	68.0630	-0.28069	-0.61859	250.0	49.1184	-0.12720	-0.64742
155.0	66.6925	-0.26769	-0.62215	255.0	48.4928	-0.12304	-0.64701
160.0	65.3846	-0.25560	-0.62546	260.0	47.8876	-0.11907	-0.64648
165.0	64.1351	-0.24431	-0.62854	265.0	47.3018	-0.11528	-0.64582
170.0	62.9403	-0.23375	-0.63136	270.0	46.7346	-0.11165	-0.64504
175.0	61.7965	-0.22386	-0.63394	273.15	46.3864	-0.10945	-0.64449
180.0	60.7007	-0.21457	-0.63627	275.0	46.1851	-0.10818	-0.64415
185.0	59.6499	-0.20583	-0.63836	280.0	45.6525	-0.10486	-0.64314
190.0	58.6416	-0.19759	-0.64021	285.0	45.1362	-0.10168	-0.64202
195.0	57.6732	-0.18983	-0.64184	290.0	44.6355	-9.8626e-2	-0.64078
200.0	56.7425	-0.18250	-0.64325	295.0	44.1498	-9.5699e-2	-0.63944
205.0	55.8475	-0.17557	-0.64446	300.0	43.6783	-9.2887e-2	-0.63799
210.0	54.9862	-0.16901	-0.64547	305.0	43.2207	-9.0187e-2	-0.63643
215.0	54.1569	-0.16279	-0.64628	310.0	42.7763	-8.7590e-2	-0.63477
220.0	53.3578	-0.15690	-0.64692	315.0	42.3446	-8.5093e-2	-0.63300
225.0	52.5874	-0.15131	-0.64739	320.0	41.9252	-8.2689e-2	-0.63113
230.0	51.8442	-0.14600	-0.64769	325.0	41.5176	-8.0373e-2	-0.62916



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THERMAL CYCLE TESTING

Sensor Model: CX-1030-SD-1.4L

Serial Number: X68201

Sensor Type: Cernox Resistor

This sensor was tested for repeatability through rapid thermal cycles from room temperature into liquid helium. During this test, the following four lead resistance values were recorded:

Approximately 305 K:	43.2 Ω
Liquid Nitrogen:	100 Ω
Liquid Helium:	434 Ω

The nitrogen and helium values were recorded in OPEN dewars, so precision comparisons with calibration values or other thermal cycle test values should not be made.

Recommended Operating Parameters:

For sensors calibrated by LSCI, the current to the sensor is adjusted to maintain the sensor output voltage or power at the values listed on the Test Data page.



BREAKPOINTS 340 FORMAT

Calibration Report: 626217

Sensor Model: CX-1030-SD-1.4L

Sensor Type: Cernox Resistor

Sales Order: 63511

Serial Number: X68201

Temperature Range: 1.40K to 325K

Name: CX-1030-SD-1.4L

Serial number: X68201

Format: 4 ;Log Ohms/Kelvin

Limit: 325.0

Coefficient: 1 ;Negative

Point 1: 1.61822,325.000	Point 56: 2.00757, 75.000	Point 111: 2.48949, 7.750
Point 2: 1.62333,319.000	Point 57: 2.01560, 72.500	Point 112: 2.50134, 7.350
Point 3: 1.62810,313.500	Point 58: 2.02220, 70.500	Point 113: 2.51242, 7.000
Point 4: 1.63298,308.000	Point 59: 2.02896, 68.500	Point 114: 2.52418, 6.650
Point 5: 1.63796,302.500	Point 60: 2.03589, 66.500	Point 115: 2.53679, 6.300
Point 6: 1.64304,297.000	Point 61: 2.04301, 64.500	Point 116: 2.55153, 5.920
Point 7: 1.64824,291.500	Point 62: 2.05032, 62.500	Point 117: 2.56494, 5.600
Point 8: 1.65354,286.000	Point 63: 2.05783, 60.500	Point 118: 2.57937, 5.280
Point 9: 1.65896,280.500	Point 64: 2.06517, 58.600	Point 119: 2.59402, 4.980
Point 10: 1.66449,275.000	Point 65: 2.07313, 56.600	Point 120: 2.60984, 4.680
Point 11: 1.67015,269.500	Point 66: 2.08133, 54.600	Point 121: 2.62592, 4.400
Point 12: 1.67593,264.000	Point 67: 2.08980, 52.600	Point 122: 2.64339, 4.120
Point 13: 1.68184,258.500	Point 68: 2.09768, 50.800	Point 123: 2.65837, 3.900
Point 14: 1.68788,253.000	Point 69: 2.10579, 49.000	Point 124: 2.67146, 3.720
Point 15: 1.69406,247.500	Point 70: 2.11416, 47.200	Point 125: 2.68543, 3.540
Point 16: 1.70038,242.000	Point 71: 2.12282, 45.400	Point 126: 2.69957, 3.370
Point 17: 1.70685,236.500	Point 72: 2.13177, 43.600	Point 127: 2.71471, 3.200
Point 18: 1.71347,231.000	Point 73: 2.14105, 41.800	Point 128: 2.73004, 3.040
Point 19: 1.72025,225.500	Point 74: 2.14960, 40.200	Point 129: 2.74651, 2.880
Point 20: 1.72718,220.000	Point 75: 2.15843, 38.600	Point 130: 2.76432, 2.720
Point 21: 1.73364,215.000	Point 76: 2.16758, 37.000	Point 131: 2.78243, 2.570
Point 22: 1.74024,210.000	Point 77: 2.17708, 35.400	Point 132: 2.80072, 2.430
Point 23: 1.74699,205.000	Point 78: 2.18694, 33.800	Point 133: 2.82052, 2.290
Point 24: 1.75390,200.000	Point 79: 2.19657, 32.300	Point 134: 2.84212, 2.150
Point 25: 1.76096,195.000	Point 80: 2.20657, 30.800	Point 135: 2.86407, 2.020
Point 26: 1.76819,190.000	Point 81: 2.21699, 29.300	Point 136: 2.88808, 1.890
Point 27: 1.77560,185.000	Point 82: 2.22715, 27.900	Point 137: 2.91252, 1.770
Point 28: 1.78318,180.000	Point 83: 2.23775, 26.500	Point 138: 2.93944, 1.650
Point 29: 1.79095,175.000	Point 84: 2.24804, 25.200	Point 139: 2.96692, 1.540
Point 30: 1.79891,170.000	Point 85: 2.25879, 23.900	Point 140: 2.99744, 1.430
Point 31: 1.80708,165.000	Point 86: 2.26921, 22.700	Point 141: 3.00674, 1.400
Point 32: 1.81546,160.000	Point 87: 2.28011, 21.500	
Point 33: 1.82406,155.000	Point 88: 2.29160, 20.300	
Point 34: 1.83200,150.500	Point 89: 2.30016, 19.450	
Point 35: 1.84014,146.000	Point 90: 2.30746, 18.750	
Point 36: 1.84848,141.500	Point 91: 2.31448, 18.100	
Point 37: 1.85705,137.000	Point 92: 2.32174, 17.450	
Point 38: 1.86584,132.500	Point 93: 2.32929, 16.800	
Point 39: 1.87488,128.000	Point 94: 2.33654, 16.200	
Point 40: 1.88418,123.500	Point 95: 2.34405, 15.600	
Point 41: 1.89375,119.000	Point 96: 2.35189, 15.000	
Point 42: 1.90252,115.000	Point 97: 2.36006, 14.400	
Point 43: 1.91153,111.000	Point 98: 2.36859, 13.800	
Point 44: 1.92080,107.000	Point 99: 2.37677, 13.250	
Point 45: 1.93036,103.000	Point 100: 2.38454, 12.750	
Point 46: 1.93775,100.000	Point 101: 2.39265, 12.250	
Point 47: 1.94404, 97.500	Point 102: 2.40114, 11.750	
Point 48: 1.95046, 95.000	Point 103: 2.41006, 11.250	
Point 49: 1.95701, 92.500	Point 104: 2.41944, 10.750	
Point 50: 1.96372, 90.000	Point 105: 2.42834, 10.300	
Point 51: 1.97058, 87.500	Point 106: 2.43770, 9.850	
Point 52: 1.97761, 85.000	Point 107: 2.44759, 9.400	
Point 53: 1.98481, 82.500	Point 108: 2.45806, 8.950	
Point 54: 1.99220, 80.000	Point 109: 2.46794, 8.550	
Point 55: 1.99978, 77.500	Point 110: 2.47839, 8.150	



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BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 626217

Sales Order: 63511

Sensor Model: CX-1030-SD-1.4L

Serial Number: X68201

Sensor Type: Cernox Resistor

Temperature Range: 1.40K to 325K

Interpolation Method: Lagrangian

Limit: 325.0 (Kelvin)

Format: 4 (Log Ohms/Kelvin)

Number of Breakpoints: 52

No.	Units	Temperature (K)	No.	Units	Temperature (K)
1	1.61823	325.0	31	2.37604	13.3
2	1.61907	324.0	32	2.40918	11.3
3	1.62162	321.0	33	2.44097	9.7
4	1.63479	306.0	34	2.47183	8.4
5	1.64872	291.0	35	2.50294	7.3
6	1.66349	276.0	36	2.53316	6.4
7	1.67915	261.0	37	2.56502	5.6
8	1.69578	246.0	38	2.59820	4.9
9	1.71348	231.0	39	2.62602	4.4
10	1.73235	216.0	40	2.65844	3.9
11	1.75252	201.0	41	2.68875	3.5
12	1.77411	186.0	42	2.71480	3.2
13	1.79732	171.0	43	2.74448	2.9
14	1.82234	156.0	44	2.77880	2.6
15	1.84944	141.0	45	2.80494	2.4
16	1.87900	126.0	46	2.83434	2.2
17	1.91155	111.0	47	2.86777	2.0
18	1.94788	96.0	48	2.88633	1.9
19	1.98923	81.0	49	2.90636	1.8
20	2.03766	66.0	50	2.92808	1.7
21	2.06755	58.0	51	2.97786	1.5
22	2.10127	50.0	52	3.00668	1.4
23	2.12480	45.0			
24	2.15070	40.0			
25	2.17954	35.0			
26	2.21211	30.0			
27	2.24566	25.5			
28	2.27830	21.7			
29	2.31122	18.4			
30	2.34408	15.6			

Temperature for Resistance Decades:

Res. (Ohms)	Temp. (K)
100	77.426
1000	1.422



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BREAKPOINTS 234 FORMAT

Calibration Report: 626217

Sensor Model: CX-1030-SD-1.4L

Sensor Type: Cernox Resistor

Sales Order: 63511

Serial Number: X68201

Temperature Range: 1.40K to 325K

Maximum Temperature Error:

1.4 - 10K:	0.008K
10 - 20K:	0.014K
20 - 40K:	0.021K
40 - 100K:	0.040K
> 100K:	0.147K

BP #	Temp. (K)	Res. (Ω)	Log10 Res.	BP #	Temp. (K)	Res. (Ω)	Log10 Res.
1	322.907	41.68694	1.620	41	10.723	263.0268	2.420
2	300.289	43.65158	1.640	42	9.745	275.4229	2.440
3	279.464	45.70882	1.660	43	8.871	288.4032	2.460
4	260.207	47.86301	1.680	44	8.092	301.9952	2.480
5	242.336	50.11872	1.700	45	7.396	316.2278	2.500
6	225.707	52.48075	1.720	46	6.774	331.1311	2.520
7	210.190	54.95409	1.740	47	6.216	346.7369	2.540
8	195.681	57.54399	1.760	48	5.717	363.0781	2.560
9	182.091	60.25596	1.780	49	5.269	380.1894	2.580
10	169.336	63.09573	1.800	50	4.866	398.1072	2.600
11	157.354	66.06934	1.820	51	4.502	416.8694	2.620
12	146.085	69.18310	1.840	52	4.174	436.5158	2.640
13	135.486	72.44360	1.860	53	3.878	457.0882	2.660
14	125.515	75.85776	1.880	54	3.609	478.6301	2.680
15	116.144	79.43282	1.900	55	3.366	501.1872	2.700
16	107.352	83.17638	1.920	56	3.144	524.8075	2.720
17	99.103	87.09636	1.940	57	2.943	549.5409	2.740
18	91.385	91.20108	1.960	58	2.759	575.4399	2.760
19	84.166	95.49926	1.980	59	2.590	602.5596	2.780
20	77.433	100.0000	2.000	60	2.436	630.9573	2.800
21	71.166	104.7129	2.020	61	2.295	660.6934	2.820
22	65.342	109.6478	2.040	62	2.164	691.8310	2.840
23	59.937	114.8154	2.060	63	2.044	724.4360	2.860
24	54.925	120.2264	2.080	64	1.933	758.5776	2.880
25	50.282	125.8925	2.100	65	1.831	794.3282	2.900
26	45.984	131.8257	2.120	66	1.736	831.7638	2.920
27	42.005	138.0384	2.140	67	1.649	870.9636	2.940
28	38.326	144.5440	2.160	68	1.568	912.0108	2.960
29	34.925	151.3561	2.180	69	1.492	954.9926	2.980
30	31.782	158.4893	2.200	70	1.422	1000.000	3.000
31	28.885	165.9587	2.220	71	1.296	1096.478	3.040
32	26.215	173.7801	2.240				
33	23.763	181.9701	2.260				
34	21.517	190.5461	2.280				
35	19.467	199.5262	2.300				
36	17.606	208.9296	2.320				
37	15.923	218.7762	2.340				
38	14.406	229.0868	2.360				
39	13.041	239.8833	2.380				
40	11.817	251.1886	2.400				



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